

Exploring the link between learning from error climate and professionals' engagement in social learning activities after errors

Learning from
error climate

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Abstract

Purpose – Learning from errors is a complex process that requires careful support. Building on affective events theory, the purpose of this paper is to explore how a supportive learning from error climate can contribute to social learning from errors through affective and cognitive error responses by individual professionals.

Design/methodology/approach – A total of 139 early-career auditors completed an online questionnaire consisting of validated survey scales, allowing for serial mediation analysis to compare direct and indirect effects.

Findings – Learning from error climate was directly and positively related to engagement in social learning activities after committing an error. Furthermore, the authors found a double mediation by error strain (an affective error response) and reflecting on errors (a cognitive error response) on this relationship.

Practical implications – Organizations can actively encourage professionals to learn from their errors by creating a supportive learning from error climate and holding professionals accountable for their errors.

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Originality/value – The present study enriches the authors’ understanding of the mechanisms through which learning from error climate influences engagement in social learning activities. It extends prior research on learning from errors by investigating the sequential effects of engagement in error-related learning activities performed individually and in social interaction.

Keywords Learning from errors, Affective events theory, Error strain, Reflecting on errors, Learning from error climate, Engagement in social learning activities

Paper type Research paper

Introduction

Human errors are ubiquitous in most, if not all, organizations, despite numerous efforts to avoid errors (Dahlin *et al.*, 2018; Goodman *et al.*, 2011; Zhao, 2011). On the one hand, errors have negative consequences for the individuals committing them (e.g. psychological stress, feeling incompetent), as well as for organizations (e.g. economic costs, damaged reputation) (Lei *et al.*, 2016; Zhao, 2011). On the other hand, errors provide an important opportunity for learning, affording advantages for both the individual (e.g. knowledge development, career development), and for the organization (e.g. innovation, improved performance) (Bauer and Mulder, 2007; Leicher *et al.*, 2013; Zhao *et al.*, 2018). Consequently, organizations have a vested interest in creating conditions that mitigate negative error consequences and that enable potential positive outcomes of errors. This requires that organizations support their employees in learning from errors, a key driver of economic sustainability and competitive advantage (Susomrith and Coetzer, 2019). In this study, we focus on the social dimension of learning from errors, defined as engagement in learning activities involving shared reflection on the causes of an error, and discussing future changes to avoid reoccurrence of the error (Bauer and Mulder, 2007; Leicher *et al.*, 2013; Leicher and Mulder, 2016). Besides analyzing an error in hindsight, social exchange helps the individual challenge one’s own (limited) perspective and deepen understanding concerning an error’s underlying causes (Grohnert *et al.*, 2019). Extant research has repeatedly shown, however, that learning from errors does not occur automatically: the work context in which an error is committed can either foster or hinder learning from it (van Dyck *et al.*, 2005; Lei *et al.*, 2016; Zhao *et al.*, 2018).

Organizational learning research has linked professionals’ perceptions of a learning-oriented work environment to a broad range of desirable outcomes (Egan *et al.*, 2004; Eldor, 2017; Govaerts *et al.*, 2011; Susomrith and Coetzer, 2019). Susomrith and Coetzer (2019) for instance found that perceived support for learning from supervisors and colleagues enhanced employees’ engagement in learning activities and work engagement. Furthermore, organizational psychology literature has established that how individual professionals perceive their work environment is a key determinant of whether or not (social) learning from errors is taking place (e.g. Edmondson and Lei, 2014; Frese and Keith, 2015). Learning from errors has been shown to be encouraged in an environment that does not place blame or punishment on those committing an unavoidable or novel error, where leaders value error analysis for future error prevention and in which professionals receive support for sharing their error experiences (Bauer and Mulder, 2013; van Dyck *et al.*, 2005; Edmondson and Lei, 2014; Frese and Keith, 2015). In this paper, we explore how a professional’s engagement in social learning from errors is driven by the work context’s learning from error climate. Learning from error climate is defined as “the collective perceptions of the members of an organization or organizational unit concerning practices, processes, structures, and behaviors that support or hinder the benefits that organizations can draw from errors” (Putz *et al.*, 2013, p. 112).

Although existing research has repeatedly highlighted that a supportive learning from error climate is a dominant driver for professionals’ learning from errors (Anselmann and Mulder, 2018; Frese and Keith, 2015; Grohnert *et al.*, 2019), very little is currently known regarding the underlying mechanisms explaining the nature of this relationship (Ye *et al.*, 2018; Zhao *et al.*, 2018).

This study builds on affective events theory (AET, Weiss and Cropanzano, 1996) to address this gap. AET proposes that a professional's behavior is driven by two kinds of responses to affective events, such as errors: by affective responses (e.g. emotions, stress) and by cognitive responses (e.g. reflection and learning). These two responses are influenced by the broader work context: professionals' respond to affective events, such as errors, in line with the values and expectations of their workplace. This leads us to the formulation of our research question: we explore whether an affective error response (error strain) and a cognitive error response (reflecting on errors) mediate the relationship between a supportive learning from error climate and the professional's engagement in social learning activities. Error strain describes negative emotions such as fear, anxiety, stress and embarrassment that result from having committed an error (Rybowiak *et al.*, 1999), and reflecting on errors describes an individual's efforts to understand error causes (Rybowiak *et al.*, 1999).

The purpose of the present study is to deepen our understanding in practice, of how early-career professionals experience errors, behave after making errors and which specific factors drive their learning from errors behaviors. This study contributes to workplace learning and error management literature by exploring the missing link between professionals' workplace perceptions and their learning from errors behaviors (Ye *et al.*, 2018; Zhao *et al.*, 2018). Moreover, we contribute to the scant literature on affective and cognitive error responses by exploring the mediating effect of professionals' emotions and reflection. These responses provide specific intervention points that can help organizations increase the effectiveness of their learning from error climate, giving guidance to individual professionals and leaders alike.

Theory and development of hypotheses

Engagement in social learning activities. Errors are defined as individual actions that result in an unintended deviation from a desired goal, and that endanger the attainment of higher-order goals, including both rule-based errors and deficiencies in available knowledge (Bauer and Mulder, 2007; Frese and Zapf, 1994; Leicher *et al.*, 2013; Rasmussen, 1987; Reason, 1995). In contextualizing learning from errors for this study, we draw on experiential learning theory (ELT; Kolb *et al.*, 2001), which frames learning as a self-directed effort to identify alternative work practices, improve performance and further professional development, and focuses on learning in terms of the engagement in learning activities (Bauer and Mulder, 2007; Bauer, 2008; van Woerkom, 2003). Engagement in learning activities after the experience of an error may take place individually or in social interaction with others such as supervisors or colleagues (Bauer and Mulder, 2007; Leicher and Mulder, 2016). The ELT models individual learning (from errors) as action-reflection cycles involving (1) reflection on the causes of an error (2), developing new work processes to avoid reoccurrence of the error and (3) the implementation of the new processes within the work context. The ELT asserts that these cycles require outside input, such as additional analyses and insights, and support for the development and implementation of new work processes (Kolb *et al.*, 2001). While individuals can learn from their errors without outside input, research on workplace learning, has emphasized the need for social interactions for effective learning (from errors) for individuals (Bauer and Mulder, 2007; Billett, 2004; Eraut *et al.*, 1998; Leicher *et al.*, 2013). Engagement in social learning activities delivers opportunities to co-construct knowledge and derive meaning from a situation (Bauer and Mulder, 2013; Cannon and Edmondson, 2005). Examples of social learning activities after making an error include root cause analysis in conversation with the supervisor, and asking more experienced colleagues what to do differently to avoid similar errors (Bauer and Mulder, 2007). Particularly in the early stages of one's career, professionals can benefit from social exchanges with knowledgeable others, as it might help them to extend their own (limited) perspectives and gain insights that they would not be able to realize without external input (Bauer and Mulder, 2013; Frese and Keith, 2015; Grohnert

et al., 2019). Following this argumentation, it can be inferred that learning in social exchange has significant benefits for professionals, making it vital to understand its antecedents. Therefore, this study focuses on engagement in social learning activities after making an error by individual professionals.

Learning from error climate. The work context plays a key role in shaping professionals' responses to errors (Edmondson and Lei, 2014; Frese and Keith, 2015). Professionals typically read their organizational context for signs about how errors are perceived and what they are expected to do about their errors (Zhao, 2011). Prior research consistently showed that when professionals are encouraged to perceive errors as sources of learning instead of as embarrassing events, they are more likely to engage in practices such as asking for help and openly discussing potential causes of errors with others, because it is safe to do so (Frese and Keith, 2015; Seifried and Höpfer, 2013). This notion is captured in the concept of learning from error climate (Putz *et al.*, 2013, p. 519), described as "perceptions of the members of an organization or organizational unit concerning practices, processes, structures, and behaviors that support or hinder the benefit that organizations can draw from errors". In line with Putz *et al.*'s (2013) description as well as Salancik and Pfeffer's social information processing approach (1978), we focus our study on the individual level of climate perceptions, referred to as a psychological climate that provides information on perception and interpretation of the work environment at the individual, rather than at the organizational level (Kundu, 2007).

This learning from error climate is shaped by (1) the behaviors of the direct supervisor, (2) the behaviors of colleagues, (3) work procedures and (4) the values shared by members of an organization. Studies across a wide range of professions have investigated the relationship between an organizations' learning from error climate and engagement in social learning activities (van Dyck *et al.*, 2005; Grohnert *et al.*, 2019; Horvath *et al.*, 2020; Leicher and Mulder, 2016). The results consistently indicate that a supportive learning from error climate positively relates to professionals' engagement in error-related learning activities. In the auditing setting, Grohnert *et al.* (2019) found that the perception of a supportive learning from error climate drives professionals' learning from errors, such that professionals who perceive their work environment as tolerant toward errors, are more likely to seek help from their supervisor after making an error. Similar results were found in healthcare (Leicher *et al.*, 2013) and financial services (Anselmann and Mulder, 2018; Leicher and Mulder, 2016).

These findings suggest that the perception of a supportive learning from error climate is a key driver of professionals' engagement in social learning activities to learn from errors. Therefore, we expect a positive relationship between individual perceptions of learning from error climate and engagement in social learning activities by individual professionals, leading to our first hypothesis:

H1. Learning from error climate positively relates to engagement in social learning activities after committing an error.

Bridging climate and learning activities – affective events theory. Despite the consistent evidence for a positive relationship between learning from error climate and professionals' engagement in social learning activities, little is known about the mechanisms through which climate translates into behavior in the context of learning from errors (Ye *et al.*, 2018; Zhao *et al.*, 2018). This study explores these mechanisms by building on AET (Weiss and Cropanzano, 1996). Applying AET to learning from errors, errors are considered an affective event, an experience that is likely to produce negative emotions, such as shame, embarrassment, doubt, and frustration at the individual level (Edmondson, 1999; Frese and Keith, 2015). AET proposes that an affective event (e.g. an error) translates into behavior, such as engaging in social learning activities, in two ways: through affective responses, and through cognitive responses. These two responses drive professionals' behaviors more directly than the work context itself. We will discuss each error response in turn in the context of learning from errors.

The mediating role of affective error responses. First, the professional will have an affective response to the error, e.g. error strain—experiencing stress or shame (Edmondson, 1999; Rybowskiak *et al.*, 1999). This response is shaped by the work environment (Weiss and Cropanzano, 1996): when colleagues have expressed stress or shame after making an error, an individual professional is more likely to respond to an error with high error strain. Conversely, when colleagues frame their errors as learning opportunities and express gratitude, the professional's affective response might be milder with lower error strain (Anselmann and Mulder, 2018; Catino and Patriotta, 2013; Frese and Keith, 2015; Shepherd *et al.*, 2011). For example, Shepherd *et al.* (2011) found that organizational members who perceive errors as highly normalized in their work environment have lower levels of negative emotions when making errors, than those who perceive errors as less normalized in their organizational environment. Similarly, Anselmann and Mulder (2018) provided evidence in the insurance industry that the perception of a safe work environment is a key factor for reducing error strain. These findings show that in line with AET, a supportive learning from error climate is negatively associated with error strain for individual professionals.

This affective response that follows from the error itself as well as from the work environment, in turn, then drives the professionals' behavior, i.e. their engagement in social learning activities (Weiss and Cropanzano, 1996). In fact, AET posits that affective responses (e.g. emotions) are a more proximate predictor for employee behaviors than contextual factors (Weiss and Cropanzano, 1996). Yet, extant research has explored the link between emotions/error strain with engagement in error-related learning activities that has resulted in a decidedly mixed picture (Anselmann and Mulder, 2018; Hetzner *et al.*, 2011; Rausch *et al.*, 2017; Seifried and Höpfer, 2013). Organizational researchers have provided evidence for fostering (Leicher and Mulder, 2016; Zhao, 2011) and inhibiting effects (Anselmann and Mulder, 2018; Hetzner *et al.*, 2011; Rybowskiak *et al.*, 1999) of negative emotions on learning from errors. On the one hand, negative emotions may foster learning by highlighting the need for improving one's performance. On the other, they may inhibit learning by using up cognitive resources so that less attention can be devoted to learning (Kanfer and Ackerman, 1989; Keith and Frese, 2005; Rybowskiak *et al.*, 1999). Consistent with AET, the limited extant research provides initial evidence that emotions after errors serve as a mediator linking perceptions of the work context and engagement in learning from errors (Steuer *et al.*, 2013; Tulis *et al.*, 2018; Zhao, 2011; Zhao *et al.*, 2018, 2019). While the majority of this work focused on the mediating role of positive affect, until now, only two studies investigated the mediating role of negative emotionality (Zhao, 2011; Zhao *et al.*, 2019). Both Zhao (2011) and Zhao *et al.* (2019) found that error strain is an essential affective mechanism mediating the relationship between supervisors' (in)tolerance of errors and learning from errors. Building further on this limited work, we expect that the perception of a supportive learning from error climate reduces the level of error strain, which in turn motivates professionals to engage in social learning activities to learn from their error, leading to the following hypothesis:

H2a. Learning from error climate negatively relates to error strain, which in turn positively relates to engagement in social learning activities.

The mediating role of cognitive error responses. Second, AET proposes that professionals react to making an error with cognitive processes such as reflecting, forming a judgment or deciding on an action path (Weiss and Cropanzano, 1996). A desirable cognitive response to committing an error is reflecting on it to understand its underlying causes (Rybowskiak *et al.*, 1999). Existing research has shown that a supportive learning (from error) climate fosters reflection on errors at the individual level (Baumgartner and Seifried, 2014; Gronewold and Donle, 2011; Hetzner *et al.*, 2011). For example, in an audit context, Gronewold and Donle (2011) found that the perception of a supportive learning from error climate drives professionals' individual engagement in reflection on their errors. Furthermore, Zhao *et al.* (2019) show a

positive association between reflecting on an error individually with learning activities performed in social interaction (e.g. sharing the error experience). Additionally, the study by Seifried and Höpfer (2013) provides evidence that a supportive learning (from error) climate promotes both engagement in individual learning activities (e.g. reflection on errors) and social learning activities after an error.

Having established that professionals' perceptions of a supportive learning from error climate foster professionals' cognitive reaction to reflect on an error, the link from individual reflection to social learning activities from the same error is not as straightforward. Engagement in social learning activities after an error (e.g. jointly discussing and analyzing the error) involves making an error public (Edmondson, 1999). Admitting errors to others entail a certain degree of risk because it can create an evaluative or social threat for the individual (e.g. losing face and appearing incompetent) (Rodriguez and Griffin, 2009). Put differently, engagement in social learning activities requires professionals to overcome a threshold. Taking this into account, we suggest that engagement in learning activities performed individually and learning activities performed in social interaction do not co-occur but typically occur sequentially. It is expected that professionals in a supportive learning from error climate first want to analyze their errors on their own before they take the step to approach others. We hypothesize the following:

H2b. Learning from error climate positively relates to reflecting on errors, which in turn positively relates to engagement in social learning activities.

Linking climate and behavior through affective and cognitive error responses. Finally, AET posits that affective and cognitive responses to events do not act independently from each other, but rather, that affective responses play into cognitive responses, with affective responses being considered to be more immediate and tacit, and cognitive responses to occur deliberately and with effort (Weiss and Cropanzano, 1996). We, therefore, explore a double mediation where a supportive learning from error climate is linked to engagement in social learning activities by sequentially affecting a professionals' affective error response, followed by the cognitive error response. Limited research showed that affective error responses are followed by cognitive error responses (Steuer *et al.*, 2013; Tulis *et al.*, 2018). For instance, Steuer *et al.* (2013) found that positive affect in the face of errors fostered students' engagement in cognitive activities to learn from the error. Building on the theoretical proposition of AET, as well as the limited empirical evidence to date, we formulate our final hypothesis:

H3. Error strain and reflecting on errors sequentially mediate the relationship between learning from errors climate and engagement in social learning activities.

Methods

Setting, sample and procedure

This study was conducted in the field of auditing among young professionals who are in the first three years of their career [1]. Auditors assess organizations' financial statements and provide assurance that the financial statements are in accordance with laws and regulations. This makes the work context of auditors more standardized than that of many other professions, as both formal education and certification processes, as well as work procedures, rewards and oversight mechanisms, are standardized at the national level. Auditors' daily work is performed in a hierarchical team setting, in which the work by lower-ranking professionals is reviewed by their direct supervisor, a setting in which many errors made by auditors are expected to be discovered (Dierynck *et al.*, 2019; Jeppesen, 2007). This hierarchical review process was specifically designed to detect and correct errors made by auditors at lower ranks—the hierarchical audit process depends on the learning from errors made at all levels, especially at the lowest level, where procedures are performed that serve as

the foundation of the audit opinion (Lambert and Agoglia, 2011). Errors made at the lowest level may escalate through the hierarchical levels, and if not corrected, potentially threaten audit quality, along with the reputation of the firm (Grohnert *et al.*, 2019; Gronewold *et al.*, 2013; Gronewold and Donle, 2011). The wider domain context and the organization of work makes auditing a suitable context for studying learning from errors individually (error strain and reflecting on errors) and in social interaction (engagement in social learning activities). Data for this study were collected during mandatory training sessions attended by Dutch beginning auditors as part of their audit certification trajectory. In this role, auditors work four days a week at their firm, integrated in a series of audit teams where they are supported by their direct supervisor as well as the wider team, in close interaction with clients. One day a week, these auditors attend formal training sessions at a university. Both components, immersion in practice and formal education, are part of the certification trajectory that takes around three years to complete. All participants filled in an online questionnaire in the presence of a researcher, making the response rate 100%. In total, 146 participants completed the online questionnaire. Yet, we had missing data from seven participants, who were subsequently excluded from the analysis. The remaining sample of 139 participants included auditors with an average of 22.1 months of work experience, with 78% of participants working for one of the Big 4 firms and 68% male participants. The approached sample appears to be representative of the population (e.g. the group of auditors who are in the first three years of their career). The distribution of males and females in the current sample is in line with the population. Moreover, the approached sample can be considered as a standardized group, since all participants entered the audit certification trajectory at the same time, and attended the structured training as a mandatory part of the trajectory. As we included all attendants of the obligatory training session, participants could not self-select into participation. As such, sample bias could be limited.

Measures

Participants completed an online survey in which they were first asked to recall a specific error they had made themselves before responding to a set of previously validated scales measuring our variables of interest as well as our covariates. This design was chosen to foster ecological validity during recall, resulting in individual-level information on how perceptions of learning from error climate translate into professionals' learning behavior.

To measure our dependent variable, respondents' engagement in social learning activities, we used the *Engagement in Social Learning Activities* (ESLA) scale of Bauer and Mulder (2013). This scale consists of three subscales: (1) a general openness to discuss the error with others (general cause analysis, three items, $a = 0.74$); (2) joint reflection on specific possible causes for the error (specific cause analysis, three items, $a = 0.66$); and (3) discussing new ways of behavior or new guidelines to prevent similar errors (development of new strategies, six items, $a = 0.78$). Sample items include: "Discuss with my colleagues why I made this error", "Discuss with colleagues whether there are gaps in my knowledge and skills," (specific cause analysis) and "Make agreements about new procedures and guidelines in a team meeting," (development of new strategies). Respondents rated all items on a five-point scale from 1 (strongly disagree) to 5 (strongly agree). In order to check the dimensionality of the scales, an exploratory factor analysis was conducted. The analysis revealed a one-factor solution, as judged by the Kaiser criterion and the screen test. The common factor explains 53% variance. The overall ESLA scale was found to be reliable with a high Cronbach's alpha of 0.85.

We captured our independent variable, *learning from error climate*, using Putz *et al.*'s (2013) short version of their scale, consisting of 16 items that assess respondents' perception of the value their firms attached to learning from errors [2]. Sample items included: "employees can talk to our supervisor about things that went wrong frankly, without

suspecting any negative consequences” and “when someone in our work group makes a mistake, other co-workers will help him/her to fix it”. Respondents rated all items on a scale from 1 (strongly disagree) to 5 (strongly agree). Again, we found a high level of reliability with a Cronbach’s alpha of 0.86.

We measured our two mediators, affective and cognitive error responses, through two previously validated survey scales. *Error strain* was assessed with the five-item subscale by Rybowskiak *et al.* (1999). Sample items included: “I find it stressful when I err, and “I am often afraid of making mistakes”. The reliability of the scale was satisfactory ($\alpha = 0.78$). *Reflecting on errors* was measured using Rybowskiak *et al.*’s (1999) five-item sub-scale of thinking about errors. Sample items included: “after making a mistake, I think about how it could happen” and “when something went wrong, I took the time to think it through”. The reliability of the scale was satisfactory ($\alpha = 0.81$).

Finally, we included a series of covariates to rule out alternative explanations for our findings. Firstly, we controlled for respondents’ gender because males and females have been found to differ in how they perceive the learning from error climate (Grohnert *et al.*, 2017) and to differ in their experience and expression of emotions (Simon and Nath, 2004). Secondly, we controlled for respondents’ work experience because prior research has demonstrated that work experience influences professionals’ learning from errors (e.g. Carmeli and Gittel, 2009; Edmondson, 1999). Thirdly, we controlled for company type (in auditing, four large firms dominate the market, known as the Big 4; these firms have more resources and offer more specialization than smaller firms), since Bishop (2017) observed that early-career auditors who work in a large firm received more opportunities for professional learning than auditors who work in smaller firms. Lastly, we controlled for participants’ natural inclination to engage in self-reflection, as it is expected that individuals with higher levels of self-reflection are also more likely to reflect on errors and engage in social learning activities after committing an error. Self-reflection was measured using Grant *et al.*’s (2002) scale. The reliability of the scale was acceptable ($\alpha = 0.75$).

Results

Descriptives and correlations

Table 1 reports the mean values, standard deviations, correlations and reliability coefficients (where applicable) for all variables included in this study. Correlations ranged from -0.32 to 0.50 , describing medium to large effects. In line with our hypotheses, learning from error climate correlated significantly, and in the expected direction, with engagement in social learning activities ($r = 0.40, p < 0.01$). Moreover, learning from error climate correlated significantly, and in the expected directions, with measures of error strain and reflecting on errors ($r = -0.32, p < 0.01; r = 0.40, p < 0.01$, respectively). Reflecting on errors correlated significantly and positively with engagement in social learning activities ($r = 0.50, p < 0.01$). In contrast to our hypotheses, however, error strain was not significantly related to engagement in social learning activities ($r = -0.10, p > 0.05$).

Tests of hypotheses

To test our mediation hypotheses, the direct (Hypothesis 1) and indirect effects (Hypotheses 2a, b and 3) of learning from error climate on engagement in social learning activities were analyzed using model 6 in Hayes’ (2013) PROCESS for SPSS macro. In line with Hayes (2013), a bias-corrected bootstrap confidence interval for the total, direct and indirect effects, based on 10,000 bootstrap samples, was calculated. We investigated indirect effects on the basis of 95% confidence intervals (CI); indirect effects were considered to be statistically significant when the CI did not include 0 (Hayes, 2013). Our results are illustrated in Figure 1.

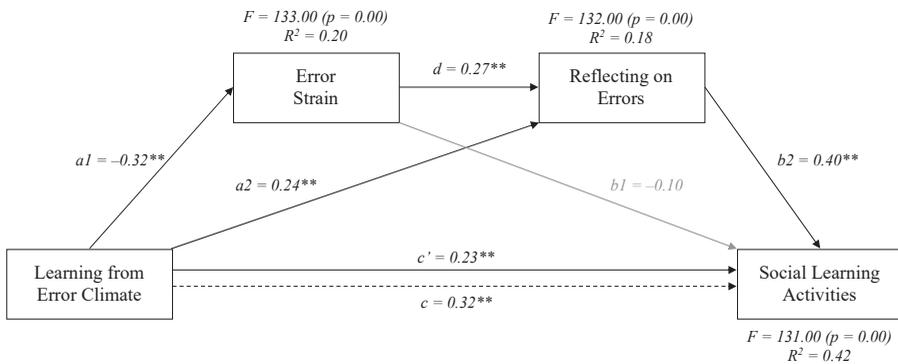
Variables	M	SD	1	2	3	4	5	6	7
1. Engagement in social learning activities	3.68	0.52	(0.85)						
2. Error strain	2.81	0.84	-0.10	(0.78)					
3. Reflecting on Errors	4.11	0.53	0.50**	0.19*	(0.81)				
4. Learning from errors climate	3.56	0.50	0.40**	-0.32**	0.14	(0.86)			
5. Self-reflection	3.32	0.52	0.36**	0.18*	0.32**	0.13	(0.75)		
6. Gender	0.31	0.46	-0.02	0.22**	-0.03	-0.15	0.08		
7. Company type	0.20	0.46	-0.16	-0.02	0.13	-0.05	-0.22**	-0.04	
8. Work experience	22.06	24.70	0.18*	-0.18*	0.02	0.03	-0.04	-0.03	0.27**

Note(s): $n = 139$. Cronbach alphas are reported in parentheses on the diagonal for relevant survey scales. Gender was coded as 0 = male and 1 = female; company type as 0 = employed at Big 4, 1 = employed at non-Big 4. Table reports Pearson correlation coefficients (two-tailed); significance indicated as * $p < 0.05$, ** $p < 0.01$

Table 1. Descriptive statistics, correlations, and scale reliability

In H1, we predicted that learning from error climate is positively related to engagement in social learning activities. Figure 1 shows that the total effect (c) of learning from error climate on engagement in social learning activities was positive and significant ($\beta = 0.32, p < 0.01$). Next, when controlling for both mediators (error strain and reflecting on errors), learning from error climate’s direct effect (c’) was reduced ($\beta = 0.23, p < 0.01$), but still significant, providing support for partial mediation in line with hypothesis 1.

H2a stated that the relationship between perceived learning from error climate and engagement in social learning activities is mediated by the affective error response of error strain. As Figure 1 reveals, we found a significant negative relationship between learning from error climate and error strain (a1) ($\beta = -0.32, p < 0.01$), and an insignificant relationship between error strain and engagement in social learning activities (b1). Overall, when error strain was the exclusive mediator between learning from error climate and engagement in



Total effect: 0.34 CI [0.18, 0.49];
 Direct Effect c': 0.24 CI [0.09, 0.40]; Total indirect effect: 0.09 CI [.01, 0.19];
 Specific indirect via error strain: 0.03 CI[-0.02, 0.09]; Specific indirect via reflecting on errors: 0.09 CI [0.01, 0.17]

Note(s): All coefficients are standardized OLS coefficients. The dotted line (c) denotes the total effect. The solid line (c') denotes the direct effect. Model includes gender, work experience, company type and self-reflection as covariates. Significance of coefficients is indicated as * $p < 0.05$, ** $p < 0.01$

Figure 1. Visual representation of the multiple mediation analyses on engagement in learning activities

social learning activities, the indirect effect (a1b1) was not significant. The standardized indirect effect was 0.03 and the CI included 0 [CI: -0.02; 0.09]. Therefore, [hypothesis 2a](#) was not supported. We found that our model explained 20% of the variance in error strain, a medium amount.

[H2b](#) predicted that the relationship between learning from error climate and engagement in social learning activities is mediated by professionals' cognitive error response of reflecting on errors. We found significant and positive relationships between learning from error climate and reflecting on errors (a2) ($\beta = 0.24, p < 0.01$, see [Figure 1](#)), and between reflecting on errors and engagement in social learning activities (b2) ($\beta = 0.40, p < 0.01$). Overall, the standardized indirect effect (a2b2) for this relationship of 0.09 is significant [CI: 0.01; 0.17]. These findings provide consistent support for [hypothesis 2 b](#). We could explain 18% of the variance in reflecting on errors, a medium amount.

[H3](#) proposed that error strain and reflecting on errors sequentially mediate the relationship between learning from error climate and engagement in social learning activities. Learning from error climate negatively related to error strain (a1, see above). Error strain in turn related positively and significantly to reflecting on errors (d; $\beta = 0.16, p < 0.01$), which in turn related positively to engagement in social learning activities (b2, see above). The overall indirect effect (a1db2) is significant at 0.09 [CI: 0.01; 0.019]. Together with the significant and positive direct effect (c') connecting learning from error climate and engagement in social learning activities, we found evidence for a partially mediated relationship, in line with both [hypotheses 1](#) and [3](#). Notably, R^2 for engagement in social learning activities was large with 42% of variance explained in the full mediation model.

Discussion

This study explored the link between learning from error climate and professionals' engagement in social learning activities through affective and cognitive error responses by individual professionals, resulting in two key findings. First, supporting prior research ([van Dyck et al., 2005](#); [Frese and Keith, 2015](#); [Grohnert et al., 2019](#)), this study reported a positive relationship between learning from error climate and engagement in social learning activities after making an error, further confirming that organizations have an active means of fostering learning from errors. Second, we could shed light on the mechanisms through which climate and behavior relate to each other. In line with AET ([Weiss and Cropanzano, 1996](#)), we found support for a double mediation, in which a company's learning from error climate is negatively related to a professional's affective error response, lower error strain, which in turn was positively related to reflecting on errors, the cognitive error response, which in turn was positively linked to engagement in social learning activities. These findings align with earlier results showing that a supportive learning from error climate reduces error strain ([Catino and Patriotta, 2013](#); [Shepherd et al., 2011](#)), as well as with evidence on the positive link between reflecting on errors and engagement in social learning activities ([Zhao et al., 2019](#)). However, we found mixed results for the link between error strain in relation to reflecting on errors and engaging in social learning activities. Error strain was positively related to individual reflecting on errors, lending support to the fostering hypothesis of negative emotions, consistent with prior limited work (e.g. [Zhao, 2011](#); [Zhao et al., 2019](#)), suggesting that negative emotions elicited by errors serve as a warning signal and alert professionals to the need to learn and improve performance. At the same time, error strain was unrelated to engagement in social learning activities, an unexpected finding. Prior literature suggests that the direction of the relationship between negative emotions and learning from errors can vary, depending on whether the emotion was triggered by outside influences (such as an unsupportive learning from error climate), or whether they emerge from the person him or herself ([Böhnke and Thiel, 2019](#); [Seifried and Höpfer, 2013](#)). It has been argued that negative

emotions that emerge within the person such as anger at oneself stimulate engagement in error-related learning activities. In contrast, negative emotions that are elicited by outward influences are speculated to impair learning from errors (Seifried and Höpfer, 2013). As this theory has not been empirically tested, it remains an important avenue for future research. Based on our findings, we conclude that the relationship between learning from error climate and engagement in social learning activities after committing an error is sequentially mediated by error strain (as an affective mechanism) and reflecting on errors (as a cognitive mechanism). This sequential mediating effect has not been observed before, and hence provides a novel perspective on the underlying mechanisms through which organizations can help professionals to learn from their errors.

Theoretical implications

The present study makes several contributions to research on learning (from errors) at work. In the past decades, a substantial body of research has demonstrated that professionals' learning from errors requires the perception of an error-tolerant climate (Frese and Keith, 2015; Putz *et al.*, 2013). However, knowledge of the underlying mechanisms that explain the nature of this relationship is still limited. Our study builds on AET (Weiss and Cropanzano, 1996) as well as on limited evidence on mediators of the climate-behavior relationship (Zhao, 2011; Zhao *et al.*, 2019). We found that first affective and then cognitive error responses sequentially mediate this well-established relationship, laying the framework for future studies seeking to understand how learning from error climate influences engagement in social learning activities. Second, this study addresses calls for future research that investigate the role of emotions in learning (from errors) at work by highlighting the need to differentiate between individual and social learning activities in relation to error strain (Böhnke and Thiel, 2019; Hökkä *et al.*, 2020). Finally, this study complements prior research (e.g. Anselmann and Mulder, 2018; Grohnert *et al.*, 2019; Hetzner *et al.*, 2011; Zhao, 2011) by directing attention to the sequential effects of engagement in error-related learning activities, first taking place individually (e.g. reflecting on errors) and subsequently in social exchange. Our results warrant future research to make a distinction between engagements in these two types of learning activities when investigating how organizations can enable professionals to most effectively learn from their errors.

Limitations and suggestions for future research

Our research entails several limitations that suggest directions for future research. First, we collected data among young professionals in a single setting, auditing. This does not allow us to explore whether the tested relationships also apply across hierarchy levels, nor to professional domains outside the audit context. Both are interesting issues for future research. Second, the cross-sectional design does not provide causal evidence for the investigated relationships, limiting our ability to quantify causal relationships between variables. Having established the indirect relationships between learning from error climate and engagement in social learning activities cross-sectionally, our results provide support for designing a targeted longitudinal study or well-controlled field-based experiment, allowing for causal inferences. Third, our results are based on respondents' self-reported data, which may be subject to recall bias. Future studies could employ a diary method, where the delay between the event (e.g. the error) and the time it is documented can be minimized, and where possible, may collect physiological data during an error experience to triangulate data sources. Fourth, our study did not directly test alternative hypotheses for the underlying mechanisms (e.g. affective error responses and cognitive error responses) in the relationship between learning from error climate and engagement in social learning activities. As a result, we cannot exclude the possibility that cognitive error responses precede affective error

responses, or that both error responses occur simultaneously. Future research is recommended to test these alternative hypotheses. Fifth, our study did not comprehensively include personality factors (such as emotional stability and trait negative affectivity) that may determine the degree of negative emotion that professionals experience after errors. Zhao (2011), for instance, examined the impact of emotional stability on the level of negative emotions and found that professionals with high levels of emotional stability were less susceptible to negative emotions and better able to manage negative emotions after errors. Similarly, Keith *et al.*'s (2020) study showed that individuals with a high dispositional tendency to experience negative affect such as anxiety or worry (e.g. trait negative affectivity) are less able to manage negative emotions after errors, especially when error consequences are severe. Therefore, future studies should include personality factors such as emotional stability in their research model, as they might provide us with richer explanations for the positive relationship between error strain and engagement in error-related learning activities.

Practical implications

By underlining and verifying the importance of a supportive learning from error climate in reducing error strain and promoting professionals' learning from errors individually and socially, this study has important implication for organizations. A supportive learning from error climate can be designed in several ways. First, organizations should clearly and consistently communicate that errors are expected to occur and engagement in error-related learning activities (such as addressing errors openly and jointly discussing errors) is expected, valued and rewarded. Organizations can actively do this by introducing regular meetings in which professionals jointly analyze and reflect upon their errors (Grohnert *et al.*, 2017; Zhao *et al.*, 2018) and through providing time off for reflection (Rodriguez and Griffin, 2009). These opportunities need to be supplemented with attention to learning from errors in e.g. promotion criteria and coaching trajectories offered to (young) professionals. Second, extant literature emphasizes the crucial role of leadership behavior in shaping an organizations' learning from error climate (Edmondson, 2011; Edmondson and Lei, 2014). By framing errors as learning opportunities, admitting their own errors and offering support for resolving and learning from errors, supervisors can role model learning from errors behavior and set the tone for a supportive learning from error climate (Grohnert *et al.*, 2019; Zhao *et al.*, 2018). Evidence from Cha and Edmondson (2006) emphasizes the need for these behaviors to be displayed consistently, both by supervisors themselves, as well as across supervisors and teams. If misalignment occurs between leaders' words and actions, professionals are likely to experience disenchantment, which relates to cynicism and withdrawal, instead of learning. Finally, we would like to highlight that the positive link between error strain and reflecting on errors should not be interpreted as a call for increasing negative emotions, e.g. through repercussions. Instead, we want to underline that organizations should emphasize professionals' responsibility for their own errors and their learning from them (Zhao *et al.*, 2018). We suggest that organizations should strive to succeed in both—creating a supportive learning from error climate as well as holding professionals accountable for their errors—offering professionals a valuable way to use error strain as a motivational impulse to start learning activities after making errors. Thus, organizations need to find the right balance between accountability and creating a culture that avoids shame and blame. As it takes two to tango, it takes competent professionals in competent organizations to learn the most from errors.

Notes

1. The aim of this research design was to explore the indirect relationships in this study with as little noise as possible. Hence, we have chosen to conduct our study in a single setting with participants who have comparable prior education and work experience, standardized responsibilities in their

work, perform tasks of similar complexity and who are enrolled in the same audit certification trajectory regulated at the national level.

2. Prior research has showed that early-career professionals can adequately reflect on their learning (from error) climate. Grohnert *et al.* (2017) for instance demonstrated among junior auditors that learning behaviors after errors depend on their perceptions of the learning from errors climate. In a similar vein, van der Rijt *et al.* (2012) investigated among early-career accountants and controllers whether individual perceptions of the learning climate encourage informal feedback seeking. It was found that perceptions of a supportive learning climate were positively associated with the frequency of feedback-seeking from supervisors. The results of these studies provide an indication that early-career professionals are aware of their learning environment and how it affects their learning behavior (after errors).

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